6/27/01

Re: 09/556,795

CP4-4D20
AU 2813

Examiner Sarkar,

Attached are documents regarding MEMS and process involving the softening temperature of glassy or amorphous material on a substrate.

It looks like Weichel and deReus, 1998, is worth a look, possibly also Sooriakumar et al., 1993 , and the three Harz and Engelke documents.

If you would like further searching or have questions or comments, please let me know.

Thanks,
Jeff Harrison,
STIC-EIC2800
306-5429
CP4-9C18

09/556,795

P15. OPTIMIZATION OF A NEW LOW-TEMPERATURE ANODIC BONDING TECHNIQUE FOR THE PACKAGING OF MEMS DEVICES, Marcus Chavez*, Chad S. Watson, Deidre A. Hirschfeld, New Mexico Institute of Mining and Technology Socorro, NM; W. Kent Schubert, Sandia National Laboratories, Albuquerque, NM 10/16/2000

Anodic bonding is a relatively low-temperature electrochemical process in which glass is hermetically sealed to silicon for use in micro electro-mechanical systems (MEMS). For this process, a voltage of 200-2000VDC is applied across a silicon substrate and a glass cover at temperatures below the softening point of the glass. Ideally, the bonding temperature is kept as low as possible to minimize thermal stresses due to coefficient of thermal expansion (CTE) mismatch. Furthermore, lower bonding temperatures reduce compatibility requirements on other materials that may be integrated into the MEMS device, such as polymers or metal layers. In the case of a Pyrex to silicon bond, CTE mismatch becomes significant at temperatures above 280° C. Typically, the temperatures used to anodically bond Pyrex to silicon range between 300-450° C. As a result, during cooling thermal stresses are created in the packaged device, thus reducing its reliability and lifetime. Recently, a new surface modification technique has been developed in which anodic bonds have been successfully produced at temperatures as low as 220° C. Experimental designs were used to optimize the surface modification technique in order to produce lower temperature bonds. The affect temperature, time, voltage and surface modification have on the formation of anodic bonds will be presented.

12th Annual Rio Grande Symposium on Advanced Materials, 10/16/00, Albuquerque, NM. New Mexico Section, Am. Ceramic Soc. And Matl. Res. Soc.

The Twelfth Annual Rio Grande Regional Symposium on Advanced Materials

Monday October 16, 2000, Holiday Inn Mountainview, 2020 Menaul Blvd, Albuquerque, NM

Contents

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Albuquerque, NM

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Albuquerque Chapter	New Mexico Section	New Mexico Section	New Mexico Chapter
Parent Organization	Parent Organization	Parent Organization	Parent Organization

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Events:

Rio Grande Regional Symposium on Advanced Materials

The 12th Rio Grande Regional Symposium on Advanced Materials
October 16, 2000
Albuquerque, New Mexico

Disclaimer:

L84 ANSWER 34 OF 47 HCAPLUS COPYRIGHT 2001 ACS
AN 1993:500881 HCAPLUS
DN 119:100881
TI **Micro**-forming of **amorphous** alloys. **Amorphous** **micro**-gear forming
AU Inoue, Akihisa; Saotome, Yasunori
CS Inst. Mater. Res., Tohoku Univ., Sendai, 980, Japan
SO Kinzoku (1993), 63(3), 51-7
CODEN: KNZKAI; ISSN: 0368-6337
DT Journal; General Review
LA Japanese
CC 56-0 (Nonferrous Metals and Alloys)
AB A review with 14 refs. is given on micro-forming of **amorphous** alloys. Research on forming of bulk **amorphous** alloys, alloy systems with high **glass**-forming tendency, manuf. and properties of bulk **amorphous** alloys, and micro-forming of the alloys in the **supercooled** liq. region are discussed.
ST review **microforming** **amorphous** alloy; gear **microforming** **amorphous** alloy review
IT Gears
(micro-, forming if **amorphous** alloy)

 MEMS

```
     FILE 'HCAPLUS, INSPEC, CEABA-VTB, COMPENDEX, NTIS, JICST-EPLUS, WPIX,
     JAPIO' ENTERED AT 09:30:05 ON 27 JUN 2001
L23         1332 S ANODIC####(1A)BOND###
L24          399 S L23 AND (L1 OR L9 OR L13 OR L5 OR L17 OR L19)
L25        31903 S L2 OR L2 OR (HEAT OR THERMAL##)(W)DEFLECT####(6A)(TEMPS OR
L26            1 S L25 AND L24   Sooriakumar, 1993

     FILE 'SCISEARCH' ENTERED AT 09:38:01 ON 27 JUN 2001
L27            1 S E9
                 E SOORIAKUMAR K, 1993/RE
L28            5 S E2-7
                 E HARZ M, 1996/RE
                 E HARZ M,1994/RE
                 E HARZ M, 1994/RE
L29            9 S E1-8

    FILE 'DPCI' ENTERED AT 09:50:18 ON 27 JUN 2001
                 E SOORIAKUMAR/REN
L30            1 S E3
    FILE 'WPIX' ENTERED AT 09:51:04 ON 27 JUN 2001
L31            1 S US 5827343/PN

     FILE 'REGISTRY' ENTERED AT 09:53:27 ON 27 JUN 2001
                 E CORNING 7740/CN
L32            1 S E3

     FILE 'WPIX, JAPIO' ENTERED AT 09:56:19 ON 27 JUN 2001
L33           23 S (ENGELKE H? OR HARZ M?)/IN
L34            2 S L33 AND BOND### AND (HEAT### OR TEMP OR TEMPS OR TEMPERATURE
                 SEL PN

     FILE 'HCAPLUS' ENTERED AT 09:59:12 ON 27 JUN 2001
L35            0 S E1-8
```

L29 ANSWER 2 OF 9 SCISEARCH COPYRIGHT 2001 ISI (R)

MEMS ?

AN 1998:707290 SCISEARCH
GA The Genuine Article (R) Number: 118JY
TI Silicon-to-silicon wafer bonding using evaporated glass
AU Weichel S; deReus R (Reprint); Lindahl M
CS MIKROELEKT CTR, DTU BLDG, 345 EAST, DK-2800 LYNGBY, DENMARK (Reprint); MIKROELEKT CTR, DK-2800 LYNGBY, DENMARK
CYA DENMARK
SO SENSORS AND ACTUATORS A-PHYSICAL, (1 OCT 1998) Vol. 70, No. 1-2, pp. 179-184.
Publisher: ELSEVIER SCIENCE SA, PO BOX 564, 1001 LAUSANNE, SWITZERLAND.
ISSN: 0924-4247.
DT Article; Journal
FS ENGI
LA English
REC Reference Count: 17
ABSTRACT IS AVAILABLE IN THE ALL AND IALL FORMATS

AB Anodic bonding of silicon to silicon 4-in. wafers using an electron-beam evaporated glass (Schott 8329) was performed successfully in air at temperatures ranging from 200 degrees C to 450 degrees C. The composition of the deposited glass is enriched in sodium as compared to the target material. The roughness of the as-deposited films was below 5 nm and was found to be unchanged by annealing at 500 degrees C for 1 h in air. No change in the macroscopic edge profiles of the glass film was found as a function of annealing; however, small extrusions appear when annealing above 450 degrees C. Annealing of silicon/glass structures in air around 340 degrees C for 15 min leads to stress-free structures. Bonded wafer pairs, however, show no reduction in stress and always exhibit compressive stress. The bond yield is larger than 95% for bonding temperatures around 350 degrees C and is above 80% for bonding temperatures higher than 225 degrees C. Purl testing revealed maximum bond strengths larger than 50 N/mm(2) and an average bond strength around 25 N/mm(2) for bonding temperatures above 300 degrees C. Structures bonded at temperatures lower than 300 degrees C show a near-linear decrease of the bond strength from 25 N/mm(2) to 0 N/mm(2) at 200 degrees C. A weak dependence on feature size was observed. For bonding temperatures higher than 300 degrees C fracture occurs randomly in the bulk of the silicon, whereas for bonding temperatures lower than 300 degrees C fracture always occurs at the bonding interface. Fracture of the glass itself was not observed.

ST Author Keywords: anodic bonding; evaporated glass; thin-film stress

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)
HARZ M	1996	143	1409	J ELECTROCHEM SOC <--

L26 ANSWER 1 OF 1 HCAPLUS

AN 1994:259013 HCAPLUS
DN 120:259013

TI Thermal mismatch strain in **anodically bonded** silicon and glass

AU Sooriakumar, K.; Meitzler, A. H.; Haeberle, R. J.; Artz, B. E.; Cathey, L. W.; Taher, I. I.
CS Electron. Div., Ford Mot. Co., Dearborn, MI, 48121, USA

SO Proc. - Electrochem. Soc. (1993), 93-29(Semiconductor Wafer Bonding: Science, Technology, and Applications), 225-9
CODEN: PESODO; ISSN: 0161-6374
DT Journal
LA English
CC 76-14 (Electric Phenomena)

AB A no. of **microsensors** are based on **anodically bonding** silicon wafers to wafers of Corning 7740 glass. Most of these sensors are electromech. devices that are very susceptible to any strain caused by either fabrication or packaging. When an **anodic bond** is formed at an elevated temp. and the bonded structure allowed to return to room temp., the whole structure distorts [1]. The silicon contracts more than the **glass** and the structure **bends** accordingly. The strain that is introduced is attributable to two major causes: (a) mismatch in the temp. coeffs. of expansion and (b) displacement of ions that occurs during the bonding operation. Most of the strain is attributable to the mismatch in expansion coeffs., but the ion displacement contribution is present and becomes significant at bonding temps. above 450.degree.C.

ST silicon glass bonding micromech sensor

IT Strain
(at silicon/glass bonding, in micromech. sensors)

IT Glass, oxide
RL: USES (Uses)
(bonding of, with silicon semiconductor for micromech sensors)

IT Sensors
(micromech., bond of silicon on glass in fabrication of)

IT Semiconductor materials
(silicon, bonding of, on glass for micromech sensors)

```
L32  ANSWER 1 OF 1  REGISTRY  COPYRIGHT 2001 ACS
RN   308062-88-6  REGISTRY    *
* Use of this CAS Registry Number alone as a search term in other STN files may
  result in incomplete search results.  For additional information, enter HELP
  RN* at an online arrow prompt (=>).
CN   Glass, oxide, borosilicate  (CA INDEX NAME)
OTHER CA INDEX NAMES:
CN   Borosilicate glasses
OTHER NAMES:
CN   4000E-CP2
CN   B 59220
CN   Borofloat
CN   Borofloat 33
CN   Borosilicate glass
CN   CG 7070
CN   Corning 7070
CN   Corning 7740
CN   Fluoroborosilicate glasses
CN   H 40
CN   H 40 (glass)
CN   Hoya FR 5
CN   Kimble KG 33
CN   OS 12
CN   OS 17
CN   Oxide glass, borosilicate
CN   Pyrex
CN   Pyrex 7740
CN   Simax
CN   Tempax
CN   Termisil
MF   Unspecified
CI   MAN, CTS
SR   CA

*** STRUCTURE DIAGRAM IS NOT AVAILABLE ***
```

L28 ANSWER 3 OF 5 SCISEARCH COPYRIGHT 2001 ISI (R)
AN 97:23632 SCISEARCH
GA The Genuine Article (R) Number: VZ290
TI Curvature changing or flattening of anodically bonded silicon and borosilicate glass
AU Harz M (Reprint); Engelke H
CS DRESDEN UNIV TECHNOL, INST SEMICOND TECHNOL & MICROSYST, D-01069 DRESDEN, GERMANY (Reprint)
CYA GERMANY
SO SENSORS AND ACTUATORS A-PHYSICAL, (31 JUL 1996) Vol. 55, No. 2-3, pp. 201-209.
Publisher: ELSEVIER SCIENCE SA LAUSANNE, PO BOX 564, 1001 LAUSANNE 1, SWITZERLAND.
ISSN: 0924-4247.
DT Article; Journal
FS ENGI
LA English
REC Reference Count: 17
ABSTRACT IS AVAILABLE IN THE ALL AND IALL FORMATS

AB A method has been developed to change or to remove stress in anodically bonded silicon and glass compounds (Pyrex or Tempax). The technology is based on the structural relaxation of the glass at temperatures at which no viscous flow is to be seen. Due to the structural relaxation, a shrinkage of the glass occurs at sufficiently high temperatures and leads to a bend change of the bonded wafers. As a result, at room temperature or at the working temperature stress-free compounds as well as those with lower and even with opposite stress and curvature can be produced. The structural relaxation of the glass has been studied by investigating the shrinkage of glass rods during isothermal annealing. The applicability to the curvature change of anodically bonded silicon and Tempax has been proved. Finally, the influence of the developed method on the decomposition and on the thermal expansion coefficient of the glass has been studied.

ST Author Keywords: anodic bonding; borosilicate glass; curvature changing; silicon; stress

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	
SOORIAKUMAR K	1993	93	225	SEMICONDUCTOR WAFER	<--

Cited Sooriakumar

L39 ANSWER 1 OF 1 REGISTRY
RN 308062-88-6 REGISTRY *
* Use of this CAS Registry Number alone as a search term in other STN files may result in incomplete search results. For additional information, enter HELP RN* at an online arrow prompt (=>).
CN Glass, oxide, borosilicate (CA INDEX NAME)
OTHER CA INDEX NAMES:
CN Borosilicate glasses
OTHER NAMES:
CN 4000E-CP2
CN B 59220
CN Borofloat
CN Borofloat 33
CN Borosilicate glass
CN CG 7070
CN Corning 7070
CN Corning 7740
CN Fluoroborosilicate glasses
CN H 40
CN H 40 (glass)
CN Hoya FR 5
CN Kimble KG 33
CN OS 12
CN OS 17
CN Oxide glass, borosilicate
CN **Pyrex**
CN Pyrex 7740
CN Simax
CN **Tempax**
CN Termisil
MF Unspecified
CI MAN, CTS
SR CA

```
L31   ANSWER 1 OF 1  WPIX   COPYRIGHT 2001   DERWENT INFORMATION LTD
AN    1996-140576 [15]    WPIX
DNN   N1996-117726         DNC C1996-044243
TI    Changing curvature of anodically bonded flat composite bodies, e.g. glass
      and metal - by heating after bonding to specified temp. to change
      curvature by shrinking glass.
DC    L01 M13 U11 U12
IN    ENGELKE, H; HARZ, M
PA    (DESP-N) DEUT SPEZIALGLAS AG; (ENGE-I) ENGELKE H; (HARZ-I) HARZ M
CYC   20
PI    DE 4436561     C1 19960314 (199615)*       5p    H01L021-58
      WO 9611806     A1 19960425 (199622)  DE   18p    B32B031-02
         RW: AT BE CH DE DK ES FR GB GR IE IT LU MC NL PT SE
          W: JP NO US
      NO 9701631     A  19970529 (199732)              B32B000-00
      EP 785870      A1 19970730 (199735)  DE          B32B031-02
          R: CH DE FR GB IT LI SE
      JP 10507415    W  19980721 (199839)       14p    B32B017-06
      US 5827343     A  19981027 (199850)              C03B023-00      <--
      EP 785870      B1 19990623 (199929)  DE          B32B031-02
          R: CH DE FR GB IT LI SE
      DE 59506282    G  19990729 (199936)              B32B031-02
ADT   DE 4436561 C1 DE 1994-4436561 19941013; WO 9611806 A1 WO 1995-EP3825
      19950927; NO 9701631 A WO 1995-EP3825 19950927, NO 1997-1631 19970410; EP
      785870 A1 EP 1995-933434 19950927, WO 1995-EP3825 19950927; JP 10507415 W
      WO 1995-EP3825 19950927, JP 1996-512881 19950927; US 5827343 A WO
      1995-EP3825 19950927, US 1997-836068 19971006; EP 785870 B1 EP 1995-933434
      19950927, WO 1995-EP3825 19950927; DE 59506282 G DE 1995-506282 19950927,
      EP 1995-933434 19950927, WO 1995-EP3825 19950927
FDT   EP 785870 A1 Based on WO 9611806; JP 10507415 W Based on WO 9611806; US
      5827343 A Based on WO 9611806; EP 785870 B1 Based on WO 9611806; DE
      59506282 G Based on EP 785870, Based on WO 9611806
PRAI  DE 1994-4436561   19941013
REP   08Jnl.Ref; JP 01004013; JP 03050141; JP 06275481
IC    ICM  B32B000-00; B32B017-06; B32B031-02; C03B023-00; H01L021-58
      ICS  C03C027-00; C03C027-02; C03C029-00; H01L021-20; H01L023-15
ICA   H01L021-02
AB    DE    4436561 C UPAB: 19960417
      In a process for changing the curvature of anodically bonded flat,
      composite bodies made of glass and metal or semiconductor materials, the
      novelty is that the body is heated after bonding to 250deg. C to 10deg. C
      below the transformation temp. of the glass of the body to achieve the
      change of curvature by shrinking the glass. Prodn. of the composite bodies
      is also claimed.
           ADVANTAGE - Planar or defined bent anodically bonded flat composite
      bodies can be produced.
      Dwg.2/2
FS    CPI EPI
FA    AB; GI
MC    CPI: L01-G10; M13-H
      EPI: U11-C18B9; U12-B03F
```

L28 ANSWER 4 OF 5 SCISEARCH COPYRIGHT 2001 ISI (R)
AN 96:322455 SCISEARCH
GA The Genuine Article (R) Number: UF815
TI STRESS REDUCTION IN ANODICALLY BANDED SILICON AND BOROSILICATE GLASS BY THERMAL-TREATMENT
AU HARZ M (Reprint); BRUCKNER W
CS DRESDEN UNIV TECHNOL, INST SEMICOND TECHNOL & MICROSYST, D-01069 DRESDEN, GERMANY (Reprint); INST SOLID STATE & MAT RES, D-01171 DRESDEN, GERMANY
CYA GERMANY
SO JOURNAL OF THE ELECTROCHEMICAL SOCIETY, (APR 1996) Vol. 143, No. 4, pp. 1409-1414.
ISSN: 0013-4651.
DT Article; Journal
FS PHYS; ENGI
LA ENGLISH
REC Reference Count: 7
ABSTRACT IS AVAILABLE IN THE ALL AND IALL FORMATS
AB A well-known problem in packaging of micromechanical devices by anodic bonding is the resulting bow of the devices. The present paper deals with a method to change this bow after bonding by annealing the wafers below the glass transition region. By means of laser optical curvature measurement the change of the bow during several annealing procedures has been observed in situ. It is shown that the bow of bonded wafer pairs can be reduced, removed, and even induced in the opposite direction. The observed bowing behavior is explained by the structural relaxation of borosilicate glass.

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	
SOORIAKUMAR K	1993		225	SEMICONDUCTOR WAFER	<--

Applicants

L80 ANSWER 3 OF 12 HCAPLUS COPYRIGHT 2001 ACS
AN 2000:45482 HCAPLUS
DN 132:268279
TI Fabrication of thin film metallic **glass** and its application to microactuators
AU **Hata, Seiichi**; Sato, Kaiji; **Shimokohbe, Akira**
CS Precision and Intelligence Lab., Tokyo Institute of Technology, Yokohama, Japan
SO Proc. SPIE-Int. Soc. Opt. Eng. (1999), 3892(Device and Process Technologies for MEMS and Microelectronics), 97-108
CODEN: PSISDG; ISSN: 0277-786X
PB SPIE-The International Society for Optical Engineering
DT Journal
LA English
CC 56-6 (Nonferrous Metals and Alloys)
Section cross-reference(s): 76
AB Metallic **glasses** are free from defects resulting from cryst. structures. Metallic **glasses** soften in a certain temp. range called the supercooled liq. region, which makes them easily formed into a 3D shape. A fabrication method is described for a thin film Zr-33.3Cu-0.4 at.% Al metallic **glass** using r.f. magnetron sputtering. Secondly a micro beam of the film is introduced. Although the fabricated micro beams bent due to the internal stress caused by stress caused by annealing them in the supercooled liq. region, straight beams were fabricated. Secondly, curved micro beams were micro formed by heating the straight beams again into the supercooled liq. state. Finally, a new type electrostatic microactuator of a conical spring shape was made. The latter was capable of stepwise motion vertical to the substrate. A 10 .mu.m step height and 30 .mu.m total height in four steps were realized.
ST **amorphous** zirconium alloy film microfabrication **microactuator**

L84 ANSWER 15 OF 47 HCAPLUS
AN 1999:735816 HCAPLUS
DN 132:67435
TI **Microforming** of **MEMS** parts with **amorphous** alloys
AU Saotome, Yasunori; Zhang, Tao; Inoue, Akihisa
CS Dept of Mechanical Eng., Gunma University, Gunma, 376-8515, Japan
SO Mater. Res. Soc. Symp. Proc. (1999), 554(Bulk Metallic Glasses), 385-390
CODEN: MRSPDH; ISSN: 0272-9172
PB Materials Research Society
DT Journal
LA English
CC 56-11 (Nonferrous Metals and Alloys)
AB Microformability of new **amorphous** alloys in the **supercooled** liq. state and microforming techniques for the materials are shown for the manuf. of micro-electro-mech. systems (MEMS). In the **supercooled** liq. state, the materials reveal perfect Newtonian viscous flow characteristics and furthermore exhibit an excellent property of microformability on a submicron scale. As for microforming techniques, micro-forging and micro-extrusion of **amorphous** alloys are introduced in addn. to the fabrication method of micro dies of photochem. machinable **glass**. As a result, **amorphous** alloys are expected as one of the most useful materials to fabricate micromachines.
ST metallic **glass micromachining microelectromech** device; zirconium **amorphous** alloy **micromachining microelectromech** device

L84 ANSWER 34 OF 47 HCAPLUS COPYRIGHT 2001 ACS
AN 1993:500881 HCAPLUS
DN 119:100881
TI **Micro**-forming of **amorphous** alloys. **Amorphous** **micro**-gear forming
AU Inoue, Akihisa; Saotome, Yasunori
CS Inst. Mater. Res., Tohoku Univ., Sendai, 980, Japan
SO Kinzoku (1993), 63(3), 51-7
CODEN: KNZKAI; ISSN: 0368-6337
DT Journal; General Review
LA Japanese
CC 56-0 (Nonferrous Metals and Alloys)
AB A review with 14 refs. is given on micro-forming of **amorphous** alloys. Research on forming of bulk **amorphous** alloys, alloy systems with high **glass**-forming tendency, manuf. and properties of bulk **amorphous** alloys, and micro-forming of the alloys in the **supercooled** liq. region are discussed.
ST review **microforming amorphous** alloy; gear **microforming amorphous** alloy review
IT Gears
(micro-, forming if **amorphous** alloy)

L40 ANSWER 1 OF 3 SCISEARCH COPYRIGHT 2001 ISI (R)
AN 2000:393343 SCISEARCH
GA The Genuine Article (R) Number: 316AH
TI Anodic bonding of evaporated glass structured with lift-off technology for hermetical sealing
AU Sassen S (Reprint); Kupke W; Bauer K
CS DAIMLERCHRYSLER AG, RES & TECHNOL FT2M, MICROSYST TECHNOL, POB 800 465, D-81663 MUNICH, GERMANY (Reprint)
CYA GERMANY
SO SENSORS AND ACTUATORS A-PHYSICAL, (22 MAY 2000) Vol. 83, No. 1-3, pp. 150-155.
Publisher: ELSEVIER SCIENCE SA, PO BOX 564, 1001 LAUSANNE, SWITZERLAND.
ISSN: 0924-4247.
DT Article; Journal
FS ENGI
LA English
REC Reference Count: 13
ABSTRACT IS AVAILABLE IN THE ALL AND IALL FORMATS
AB This paper reports on an enhanced anodic bonding technology of thin e-beam evaporated glass layers (d less than or equal to 5 mu m) for micromachined silicon sensors and actuators. This MOS-compatible technology has been developed for bonding between a silicon wafer with electrical structures and a bulk micromachined silicon wafer. A bonding frame structure can be realized with hermetically sealed metal feedtroughs especially suited for capacitive sensors with a small sensing gap and fast RC-time constants. A lift-off technology for structuring the glass using metal as a sacrificial layer has been developed, because the substrates were heated to about 300 degrees C in order to enhance the quality of the glass layer. A simple model for the current flow during the bonding process is given. The numerically calculated current-voltage behaviour is compared with measured data. An electrostatically excited silicon resonator is realized to demonstrate the applicability of this technology.

ST Author Keywords: anodic bonding; evaporated glass; hermetical sealing; metal feedtrough; capacitive sensors

Referenced Author (RAU)	Year (RPY)	VOL (RVL)	PG (RPG)	Referenced Work (RWK)	
WEICHEL S	1998	70	179	SENSOR ACTUAT A-PHYS	<--

FYI 6/27/01 09/556,795

Abstract for Japanese equivalent to 09/556,795

L43 ANSWER 2 OF 3 WPIX COPYRIGHT 2001 DERWENT INFORMATION LTD

AN 2000-666857 [65] WPIX

DNN N2000-494268 DNC C2000-202134

TI Thin film structure manufacturing method involves heating super cooled liquid region of thin film and applying mechanical external force using acicular unit on thin film such that it is curved.

DC L03 Q68 S01

PA (TOKD) TOKYO INST TECHNOLOGY; (TOKD) TOKOY INST TECHNOLOGY

CYC 1

PI JP 3099066 B1 20001016 (200065)* 12p B81C001-00
JP 2000317900 A 20001121 (200108) 23p B81C001-00

ADT JP 3099066 B1 **JP 1999-126680 19990507**; JP 2000317900 A **JP 1999-126680 19990507**

PRAI **JP 1999-126680 19990507**

IC ICM B81C001-00
ICS C03B023-00; C22C045-00; C23C030-00

ICA C23C014-35; G01R001-073

AB JP 3099066 B UPAB: 20001214

NOVELTY - Thin film (42) comprising amorphous material with super cooled liquid region, is formed on preset substrate. The super cooled liquid region of thin film is heated and mechanical external force is impressed to thin film using acicular unit, such that thin film is curved to form thin film structure which is then cooled to room temperature.

DETAILED DESCRIPTION - Electrode layer adjoining the thin film, with conductive material, opposes the counter electrode. Voltage is impressed between electrode layer and counter electrode and load of electrostatic external force caused between them to form thin film. A magnetic layer opposes to provide the magnet.

USE - For manufacturing thin film structure for use as various probes e.g. sensors, micro machines, micro actuator, contact needle, micro sensor.

ADVANTAGE - Since amorphous material is formed with super cooled liquid region, high productivity and high reproducibility are obtained. Provides thin film structure with stable shape after molding.

DESCRIPTION OF DRAWING(S) - The figure shows the example of manufacturing method of thin film structure.

Thin film 42

Dwg.1/28

FS CPI EPI GMPI

FA AB; GI

MC CPI: L03-J
EPI: S01-H03